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New records of Eulophidae (Hymenoptera, Chalcidoidea) from Iran

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A b s t r a c t : During 2011-2012, six species and five genera belonging to the family Eulophidae were collected in Kerman province, Iran, which are the new records for this country. The identified species attribute to two subfamilies of Eulophinae known as *Euplectrus indicus*, *Elasmus masii*, *Hemiptarsenus nuperus* and Tetrastichinae: *Aprostocetus gala*, *Aprostocetus malcis*, *Sigmophora flammus*. Short taxonomic comments, biological data as well as geographical distribution for each species are briefly mentioned. A key to identification of these species in Kerman province is presented.

K e y w o r d s : Eulophidae, fauna, new records, distribution, southeast Iran.

Introduction

Eulophidae (Hymenoptera: Chalcidoidea) is the most diverse family in the Chalcidoidea containing about 4.472 species, placed in 297 genera and four subfamilies (Entedoniinae, Entiinae, Eulophinae and Tetrastichinae) (NOYES 2015). They are predominantly parasitoids of other insects such as Lepidoptera, Coleoptera, Diptera and Hymenoptera, thereby many other hosts are also used. Most of the eulophids are parasitoids of concealed hosts such as leaf miners, wood borers, leaf rollers, and gall formers. Entedoninae and Tetrastichinae attack a wide variety of hosts, whereas Eulophinae and Entiinae (Euderinae) are relatively limited in their host preferences. In particular, Tetrastichinae are exceptional in their host range parasitizing over 100 families of host in 10 insect orders as well as eggs of spiders (Araneae), mites (Acari), and nematodes (LASALLE 1994). Some species may be idiobiont ectoparasitoids (Eulophinae and Entiinae) or endoparasitoids (Entedoninae and many Tetrastichinae) (HESAMI 2009). Several species of Eulophidae are important in biological control programs throughout the world (NOYES 2015). During the past 50 years, various authors provided records of Eulophidae from Iran. DAVACHI & CHODJAI (1969) presented the first list of Iranian parasitoids that included only two eulophid species. Several species records were published by MODARRES-AWAL (1994) and SHOJAI (1998). In the recent years the number of known eulophid species for the fauna of Iran showed significant growing (DOĞANLAR 1992; MAHANI et al. 2003; REZAEI et al. 2003; ZAHIRI et al. 2003; HESAMI et al. 2005; TALEBI et al. 2005; HESAMI et al., 2006; HESAMI et al., 2007; YEFREMOVA et al. 2007; DOUSTI et al. 2008; EBRAHIMI et al. 2009; HESAMI et al. 2010a,b; TALEBI et al. 2011). The last

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published work of eulophid fauna of Iran was provided by HESAMI et al. (2010b) who presented a checklist containing 122 species from different parts of Iran. Due to biogeographical and ecological reasons, it is not surprising that within the country there are large numbers of species remain to be discovered. The aim of this study is to add new species to the list of Iranian Eulophidae and to complete with new information on the distributional data for the listed species.

Material and methods

The material from southeastern Iran was collected using standard sweeping net and malaise traps at several localities located in Kouhpayeh area, Kerman province during 2011-2012. It was preserved in 75% Ethanol until it was partly mounted on cards. Prior to mounting the specimens were treated with hexamethyldisilazane in order to avoid collapsing. The identified material is deposited in Department of Plant Protection, Islamic Azad University, Shiraz branch, Iran. The identified species are ordered based on subfamily name alphabetically. The taxonomic arrangement of BOUČEK (1988) for subfamilies is followed in this paper (HANSSON & STRAKA 2009). The morphological terminology followed GRAHAM (1987, 1991) and ASKEW & BOUČEK (1968). Synonyms, combinations and misspelling are according to NOYES (2014). The abbreviations used in the text are as follows: F1 = first segment of antennal funicle; F2 = second segment; SMV = submarginal vein; MV = marginal vein; PMV = postmarginal vein; SV = stigmal vein. Sculpture terminology follows EADY (1968). Absolute measurements in millimetres (mm) are used for body and forewing lengths of specimens.

Results

Key to the identification of eulophid genera and species collected in the present study

1 Mesoscutum with notauli incomplete, Scutellum with at least 2 pairs of setae. Eulophinae 3

- Mesoscutum with notauli clearly visible, complete 2

2 Axillae not angulately advanced or, if approaching that condition, submarginal vein at distal end smoothly curving into parastigma. Postmarginal vein mostly longer than, rarely only as long as the stigma. Eulophinae 4

- Axillae strongly angulately advanced along hind portion of the straight, groove like notauli or, if axillae only moderately advanced, submarginal vein usually not smoothly continuous with parastigma. Postmarginal vein mostly rudimentary Tetrastichinae 5

3 Flagellum not distinctly clavate, scape very distinctly exceeding vertex level. Female antennal funicle 4-segmented. Male flagellum with 3 long branches. Body slender .... *Hemiptarsenus nuperus* NARENDRAN, 2011

- Flagellum clavate, short and compact. Female antennal funicle 4-segmented. Male antennal funicle with branches. Metacoxa grossly swollen and laterally flattened..... ..... *Elasmus masii* FERRIÈRE, 1929

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4 Scutellum without sublateral grooves, finely sculptured or almost smooth. Metasoma black at apex and on sides; hind coxae yellow; head with only supraclypeal area and clypeus yellow or reddish brown. Male with sensillar area which starts 1/5 from base of scape, scape less than 3.3 times as long as broad. Pronotom anteriorly always carinate ..... *Euplectrus indicus* FERRIÈRE, 1941

- Scutellum with crenulate or aveolate groove along apical margin 5

5 Midlobe pilosity reduced to adnotaular, hairs not on tubercles. Mouth normally developed. With distinct mandibles. Female: Malar sulcus with triangular fovea below eye; transverse carina behind lateral ocelli; scape 5.6 times as long as broad; Male antenna with whorled setae of F1 reaching to two-thirds the length of F3; metanotum rounded and about 4 times as broad as long; length of last gastral tergite 1.7 times as long as its basal breadth..... *Sigmophora flammus* YEFREMOVA & YEGORENKOVA, 2009

- Midlobe without unusual area of striation 6

6 Submarginal vein with 4 dorsal setae. Metasoma slightly longer than head plus mesosoma..... *Aprostocetus gala* (WALKER, 1847)

- Submarginal vein with 3 dorsal setae ..... *Aprostocetus malcis* NARENDAN, 2007

List of Species

E u l o p h i n a e

Euplectrus indicus FERRIÈRE, 1941

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Darbasiyab, 30°30´N; 57°10´E, 2321m, 17.XII.2012, swept on *Medicago sativa* (S. SHAFIEE), 1♂.

D i a g n o s i s : Scutellum very vaguely reticulate, nearly smooth; mid lobe of the mesoscutum with only 3 pairs of setae, with complete median carina; metasoma black at apex and on sides; hind coxae yellow; head with only supraclypeal area and clypeus yellow or reddish brown. Male with sensillar area which starts 1/5 from base of scape, scape less than 3.3 times as long as broad (ZHU & HUANG 2003).

B i o l o g y : Host range is very broad. This species is considered as parasitoid of *Apanteles* sp. (Braconidae) and Geometridae (Lepidoptera) (ZHU & HUANG 2003).

D i s t r i b u t i o n : China, Taiwan, Japan, Mexico (ZHU & HUANG 2003).

Elasmus masii FERRIÈRE, 1929

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Deh Lolo, 30°27´N; 57°16´E,1982m, 12.XIII.2011, swept on *Medicago sativa* (S. SHAFIEE), 2♀♀.

D i a g n o s i s : Dark brown tibia and tarsi, the tibial spurs alone being pale yellow (FERRIÈRE 1929).

B i o l o g y : This species is primary parasitoid of Chrysomelidae (Coleoptera), Agromyzidae (Diptera) and (Homoptera: Diaspididae, Coccidae, Psyllidae) (FERRIÈRE 1929).

D i s t r i b u t i o n : Worldwide (NOYES 2015).

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***Hemiptarsenus nuperus* NARENDRAN, 2011**

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Darbasiyab, 30˚30´N; 57˚11´E, 2543m, 11.XII.2012. *Medicago sativa* (S. SHAFIEE), 3♂♂.

D i a g n o s i s : Body Length 1.7- 1.8 mm. Clypeal sutur short, Trulli much higher than center of the face, Head Lenght 0.3 mm. Scape long, passes far from vertex, Flagellum 4 segmented, Antenna with 3 flagellomers; basal flagellomere branched. Mesosoma 0.7mm, Notauli incomplete, axillae only slightly advanced anteriad of Scutellum. Scutellum without submedian or sublateral grooves. Legs elongate. Wing length 1.7 mm. Abdomen lenghth 0.6 mm.

B i o l o g y : unknown.

D i s t r i b u t i o n : India (NOYES 2015).

T e t r a s t i c h i n a e

***Aprostocetus gala* (WALKER, 1847)**

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Shahid Bahonar camp, 30˚30˝N; 57˚9´E, 2441m, 11.VII.2012, ex galls on *Rosa beggeriana* SCHRENK (S. SHAFIEE), 6♀♀ & 5♂♂.

D i a g n o s i s : Female: Yellow with the following parts dark brown: antenna (with scape paler); upper part of scrobe, area near ocelli on vertex, apical corners of scapula and axilla, natauli, anterior corners of propleuron and transverse bands on gaster; antenna with 2 anelli; F1 equal to F2; mesoscutum with single row of five adnotaular setae on either side; SMV with four dorsal setae; metasoma slightly longer than head plus mesosoma (NARENDRAN 2007).

B i o l o g y : This species is a parasitoid of (Diptera: Cecidomyiidae) and (Coleoptera: Curculionidae) (NARENDRAN 2007).

D i s t r i b u t i o n : Australia, Dominica, Guadeloupe, Jamaica, Montserrate, Nearctic, Puerto Rico, Saint Lucia, USA and India (NARENDRAN 2007).

***Aprostocetus malcis* NARENDAN, 2007**

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Dehfaghire, 30°29´N ‹ 57˚11´E , 2342m, 11.VII.2012, swept on *Medicago sativa* (S. SHAFIEE), 1♀.

D i a g n o s i s : Female: Length 1.35mm. This is a distinctive species characterized by large mandibles with falcate inner (ventral) tooth; SMV with 3 dorsal setae (NARENDRAN 2007).

B i o l o g y : This species was already reared from *Ferrisia virgata* (COCKERELL) (Pseudococcidae, Homoptera) on *Ficus glomerata* ROXB. (NARENDRAN 2007).

D i s t r i b u t i o n : India (NARENDRAN 2007).

***Sigmophora flammus* YEFREMOVA & YEGORENKOVA, 2009**

M a t e r i a l e x a m i n e d : Iran: Kerman, Kouhpayeh, Derakhtangan, 30˚28´N; 57˚18´E 1831m, 25.XIII.2012, swept on *Medicago sativa* (S. SHAFIEE), 1♂.

D i a g n o s i s : Female: Malar sulcus with triangular fovea below eye, narrower than in *S. brevicornis*, less than one-third the height of the malar space; transverse carina

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behind lateral ocelli, second transvers carina behind lateral ocelli, second transverse carina posterior to median ocellus; scape 5.6 times as long as broad; male antenna with whorled setae of F1 reaching to two-thirds the length of F3; metanotum rounded and about 4 times as broad as long; length of last gastral tergite 1.7 times as long as its basal breadth (YEFREMOVA et al. 2009).

B i o l o g y : This species is considered as parasitoid of coffee leafminer, *Leucoptera coffeella* GUÉRIN-MENEVILLE, (Lepidoptera: Lyonetiidae) (YEFREMOVA et al. 2009).

D i s t r i b u t i o n : Yemen (YEFREMOVA et al. 2009).

Discussion

Kerman province has an area of 180.726 km2 (about 11% of Iran) (http://en.wikipedia.org/wiki/Kerman_Province) and comprises parts of the main mountains of Iran that provides topographically and climatologically very heterogenus and diverse natural habitats (ZEHZAD et al. 2002). The physical features of Kerman province are primarily deserts, but the mountain chain in the Kouhpayeh region, place of this reserach, and the height over 1950 meter, makes this place a semi-arid to moderate position with country-side weather with a rich fauna and flora. It is also located near the border of western and eastern Palaearctic zoogeographic zone. Thus, more samplings is needed to get a more complete picture of the eulophid fauna of this region. Most identified species occur in other zoogeographical regions: *E. indicus* previously was found in Far-east and Mexico and this is the first report in Palaearctic region. *E. masii* has a worldwide distribution. *H. nuperus* was already found in India, and here is the second report of this species. It seems that *A. gala* was already reported from Nearctic and Australia, so we have found it from Palaearctic for the first time. *A. malcis* was already reported from India and here is the first report in the Palaearctic region. *S. flammus* was already described by specimens from Yemen, and here is the second report of this species. Making six new reports from this region is an important task to show the biodiversity of Eulophidae in region with very diverse zoogeographical distribution. We thought that there are many more species of Eulophidae in Iran and it needs more comprehensive investigations to increase the knowledge on biodiversity of this valuable group in Iran.

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Zusammenfassung

Im Zeitraum 2011 bis 2012 wurden in der iranischen Provinz Kerman sechs Arten der Familie Eulophidae (Hymenoptera) nachgewiesen (Eulophinae: *Euplectrus indicus*, *Elasmus masii*, *Hemiptarsenus nuperus* und Tetrastichinae: *Aprostocetus gala*, *Aprostocetus malcis*, *Sigmophora flammus*), die gleichzeitig Erstnachweise des Untersuchungsgebietes darstellen. Neben taxonomischen Anmerkungen und biologischen Daten werden Angaben zur Verbreitung gemacht. Ein Bestimmungsschlüssel für die Provinz Kerman ergänzt die Arbeit.

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